



**State of Louisiana
Department of Natural Resources
Coastal Engineering Division**

**2005/2006 Annual Inspection
Report**

for

**BRADY CANAL HYDROLOGIC
RESTORATION**

State Project Number TE-28
Priority Project List 3

August 17, 2006
Terrebonne Parish

Prepared by:

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I. Introduction

The Brady Canal Hydrologic Restoration Project consists of 7,653 acres located in the Terrebonne Basin, within the Bayou Penchant - Lake Penchant watershed in Terrebonne Parish, Louisiana. The project is bounded by the Bayou Penchant, Brady Canal, and Little Carencro Bayou to the north, Bayou Decade and Turtle Bayou to the south, Superior canal to the east, and Little Carencro Bayou and Voss Canal to the west (Attachment I).

The Brady Canal Project is a hydrologic restoration project consisting of the installation and maintenance of one (1) fixed crest weir with barge bay, several variable crest weirs, earthen embankments and overflow banks, rock and rock armored earthen embankments, rock armored channel liners, rock dikes and rock plugs. These structures were designed to reduce the adverse affects in the project area and to promote freshwater introduction to better utilize available freshwater and sediment retention as well as encourage re-establishment of emergent and sub-aquatic vegetation in eroded areas.

The Brady Canal Hydrologic Restoration Project was authorized by Section 303(a) of Title III Public Law 101-646, the Coastal Wetlands Planning Protection and Restoration Act (CWPPRA) enacted on November 29, 1990 as amended and approved on the third Priority Project List. The Brady Canal Project has a twenty –year (20 year) economic life, which began in July 2000.

In 2003, The CWPPRA Task Force determined that, due to LDNR being the responsible party for the Operation and Maintenance phase of the vast majority of the CWPPRA projects, CWPPRA authorized LDNR, through SPR 15950, to be the responsible party for all Post Storm/ Hurricane Assessments. After Hurricanes Katrina and Rita, every project appeared to be impacted by the storms; therefore, DNR determined that all projects should be assessed for damages (Damage Assessment Cumulative Report, 2006). The inspection included a visual observation of all constructed project features and recommend possible corrective actions should maintenance be required. The annual inspection of the Brady Canal Project (TE-28) usually occurs in the first quarter (March/April) of each year; however, due to the destruction of Hurricanes Katrina and Rita, a damage assessment was performed immediately following the storms in October 2005. With concurrence from the landowners (Burlington Resources and Apache Corporation) and the federal partner (Natural Resource Conservation Service), LDNR has decided not to perform the field inspection scheduled for March 2006 but rather use the field information gathered on the damage assessment field trip in October 2005 to produce the 2006 annual inspection report.

II. Inspection Purpose and Procedures

The purpose of annual inspections is to evaluate the constructed project features to identify any deficiencies and prepare a report detailing the condition of project features and recommended corrective actions needed. Should it be determined that corrective actions are needed, LDNR shall provide, in the report, a detailed cost estimate for engineering, design,

supervision, inspection, and construction contingencies, and an assessment of the urgency of such repairs (O&M Plan, 2002). The annual inspection report also contains a summary of maintenance projects which were completed since completion of constructed project features and an estimated projected budget for the upcoming three (3) years for operation, maintenance and rehabilitation. The three (3) year projected operation and maintenance budget is shown in Attachment II. A summary of past operation and maintenance projects completed since completion of the Brady Canal Project are outlined in Section IV of this report.

On October 5, 2005, representatives of LDNR Field Engineering (Brian Babin and Darin Lee), LDNR Design Section (Amanda Phillips), NRCS Construction and O&M Manager (Brad Sticker) and Burlington Resources (Evan Adams) performed a damage assessment inspection of the Brady Canal Hydrologic Restoration Project.

The field inspection included a complete visual inspection of the entire project site. Staff gauge readings and existing temporary benchmarks were used to determine approximate elevations of water, rock weirs, earthen embankments, steel bulkhead structures and other project features. Hand held GPS units were used to mark low areas of rock dikes and earthen embankments which may require corrective actions or monitoring on future site visits. Field Inspection notes completed in the field to record measurements and deficiencies are shown in Attachment III of this report.

III. Project Description and History

The Brady Canal Hydrologic Restoration Project (TE-28) was completed in July 2000 and involved the installation and maintenance of fixed crest weirs with barge bays and variable crest sections, construction and maintenance of earthen embankment, rock and rock armored earthen embankments, and the placement of rock armor to stabilize the channel cross-sections. These structures are designed to reduce the adverse tidal effects in the project area (that have occurred through man-made channels and the enlarged natural channels) and to promote freshwater introduction to better utilize available freshwater and sediment retention (Monitoring Plan, 1998). The principle project features of the Brady Canal Hydrologic Restoration Project include the following:

- Site 6 – fixed crest weir with barge bay
- Site 7 – rock plug
- Site 10 – stabilization rock armored channel liner
- Site 14 – fixed crest weir with variable crest section
- Site 20 – stabilization rock armored channel liner
- Site 21 – fixed crest weir with three (3) variable crest sections
- Site 23 – fixed crest weir with two (2) variable crest sections
- Site 24 – fixed crest weir
- 4,405 linear ft. – rock armored earth embankment
- 3,660 linear ft. – rock dike
- 8,531 linear ft. – Earthen embankment
- Maintenance of existing over-flow banks (21,600 ft.)

The objective of the Brady Canal Hydrologic Restoration Project is to maintain and enhance existing marshes in the project area by reducing the rate of tidal exchange and improve the retention of introduced freshwater and sediment. Specific goals are to (1) decrease the rate of marsh loss, (2) maintain or increase the abundance of plant species typical of a freshwater and intermediate marsh, (3) decrease variability in water level within the project area, (4) decrease variability in salinities in the southern portion of the project, (5) increase vertical accretion within the project area and (6) increase the frequency of occurrence of SAV within the project area. (Monitoring Plan, 1998)

The Brady Canal Hydrologic Restoration project is bisected by the Mauvais Bois Ridge, resulting in different hydrologic regimes to the north and south of the ridge. The northern section of the project area still receives freshwater and sediments which is provided through over-bank flow from Bayou Penchant, Little Carencro Bayou, and Brady Canal (USDA/NRCS 1995). The Mauvais Bois Ridge forms a barrier to reduce the outflow of freshwater. Freshwater and sediment retention has diminished in the southern portion of the project area due to unimpeded through-flow and tidal exchange combined with a decrease in freshwater and sediment (USDA/NRCS, 1995).

Major changes to the hydrology of the Penchant Basin, both natural and human induced, have resulted in a complex hydrologic setting (USDA/NRCS, 1995). Under natural hydrologic conditions, the Penchant Basin is confined by natural levee ridges and is open to the west and southwest where it connects with the lower Atchafalaya River, Atchafalaya Bay, and Fourleague Bay. Historically, this hydrologic setting produced an estuarine system created by freshwater introduction in the upper basin and tidal exchange with the bays. Over time hydrologic conditions in the Penchant Basin were altered by the construction of numerous canals, levees, local water management structures, and major public works projects. Some of the major projects that have helped to alter the hydrology in the basin are the Atchafalaya Basin Floodway, the Avoca Island levee along the lower Atchafalaya River, the Gulf Intracoastal Waterway (GIWW), the Bayou Chene, Boeuf, and Black Projects, the rock weir at Wax Lake, and the Houma Navigation Canal (USDA/NRCS 1995).

Historically, the Atchafalaya River provided freshwater and sediments to the Penchant Basin through the diversion of flood waters into Bayou Cocodrie via Bayou Boeuf at Morgan City, and into Bayou Penchant via Bayou Shaefer and Bayou Chene (USDA/NRCS 1995). Freshwater input and sediment retention from the Atchafalaya River diminished after the construction of the Atchafalaya Basin Floodway, the Bayou Boeuf Lock on the GIWW, and the construction of the Avoca Island Levee. Additionally, the dredging of numerous canals in the basin has resulted in the breaching of natural hydrologic barriers allowing for a strong tidal influence. These anthropogenic changes have resulted in an acceleration of tidal exchange between freshwater distribution channels and tidal channels thus reducing freshwater retention, accelerating erosion, and facilitating saltwater intrusion (USDA/NRCS 1995).

Also, the natural levee ridge of Bayou DeCade has eroded to below marsh elevation over several thousand feet along the southern project boundary. This has created a direct hydrological connection between the higher salinity waters from the south and the project area

as well as decreasing protection from storm surges and tidal scouring. In addition, oilfield access canals extending from within the project area to the Bayou Decade levee ridge have also increased tidal exchange and provided direct routes for saltwater intrusion and reduced freshwater and sediment retention (USDA/NRCS 1995).

IV. Summary of Past Operation and Maintenance Projects

General Maintenance: Below is a summary of completed maintenance projects and operation tasks performed since July 2000, the construction completion date of the Brady Canal Hydrologic Restoration Project (TE-28).

Under Article II of the Brady Canal Cost Share Agreement, the landowners, Burlington Resources and Apache Corporation were granted in-kind service credits to repair existing earthen embankments within the project area. Below is a description of work and cost associated with the maintenance performed by Burlington and Apache:

In-kind Service Credits - Burlington Resources: Burlington Resources completed the repair of two (2) large breaches along Little Carencro Bayou resulting from Hurricane Lili. The maintenance project was completed on 8/15/2003 at a total cost of **\$31,642.57** including construction oversight and administration.

In-kind Service Credits - Apache Corporation: On 10/31/2003, the Apache Corporation completed 5,050 linear feet of levee refurbishment along the west bank of Jug Lake. The total cost for the levee refurbishment including construction oversight was **\$34,284.87**. Shaw Coastal performed an as-built survey of the refurbished levee for **\$5,100.60**.

In-kind Service Credits - Apache Corporation: As a result of Hurricane Lili, existing levee embankments along Turtle Bayou, Superior Canal and along the west bank of Jug Lake were breached. Apache repaired these breaches as in-kind services for a total of **\$5,310**.

Brady Canal Breach Repair Project – LDNR: This maintenance project included the installation of approximately 9,667 tons of broken stone riprap, 2,325 linear feet of earthen breach repair, and replacement of timber pile on dolphin at structure 6. Construction was completed on 8/13/2003. The cost associated with the engineering, design and construction of the Brady Canal Breach Repair Project is as follows:

Construction:	\$471,329.65
Engineering & Design:	\$ 54,473.00
Bidding:	\$ 4,100.00
Construction Administration:	\$ 8,020.00
Construction Oversight:	\$ 49,635.00
As-built Survey and Drawings:	<u>\$ 12,873.00</u>

Project Total: \$604,289.65

2003 Structure Operations: In accordance with the operation schedule outlined in the Operation and Maintenance Plan, Structures 14, 21, & 23 were manipulated twice in 2005 by T. Baker Smith & Sons at an annual cost of approximately \$16,000.

Navigational Aids Maintenance: Since completion of the Brady Canal Project, the navigational aids at structure 6 along Bayou Decade have been repaired on two (2) separate occasions. Below are the dates and costs associated with the repair and maintenance of these navigation lights:

8/02 - Automatic Power, Inc. of Larose, La. performed trouble shooting services to determine a schedule of parts requiring replacement – Cost: **\$465**

8/02 – B&B Electromatic of Norwood, La. repaired the navigation lights at Structure #6 including parts and labor for a total cost of **\$2,039**.

11/03 – Ernest P. Breaux Electrical Inc. replaced 20 lamps, 4 – batteries, 1 – lamp changer, 1 – photo cell at Site No.6. The cost for parts and labor to service these navigational aids was **\$4,132.30**.

11/04 – Automatic Power of Larose replaced two (2) lamp changers and fittings, one (1) external solar cell, one (1) 12v battery and twelve (12) 25 amp. bulbs at Site #6. The cost for parts and labor to service these navigation lights was \$2,055.25

V. Inspection Results

General Observations:

From the amount debris noted on top of the earthen embankments and rock structures, it is apparent that the entire project area was inundated with several feet of water from the storm surge of Hurricane Rita. We also observed that the marsh grass and vegetation along spoil banks throughout the entire project area was burnt due to high salinities during the storm. However, floating marshes in the area did not appear to be highly disturbed (moved, turned over, etc...) and recovery would be expected. Higher salinities after the storm are the major concern due to lack of rainfall in the area since the storms.

The staff gauges in the project area assessable by outboard were either damaged are not correct. Therefore, no gauge readings were taken. However, from measurements of known elevations on rigid structures in the area, it was determined that the water levels were approximately 2.2' NAVD.

TE-28 Brady Canal Hydrologic Restoration

Inspection Results:

The damage assessment of the Brady Canal Project began at approximately 10:15 a.m. on the southeastern end of the project area at the intersection of Turtle Bayou and Bayou Decade. All existing spoil banks along Turtle Bayou and Superior Canal were in good condition with no significant erosion or degradation noted. The rock dike and earthen embankments along Bayou Decade and Jug Lake were also in fair to good condition with no visible signs of storm damage.

Structure No. 23 – Upon inspection of structure no. 23, we observed that the earthen embankment tie-in on the north side of the structure had eroded around the structure exposing the end of the steel bulkhead. There is a small portion of the earthen embankment remaining behind the structure on the marsh side preventing a breach from forming. This has been an area of concern during previous inspections and will require maintenance in the near future.



Structure #23 – significant erosion on the north side of the structure exposing the bulkhead.

Structure No.6 – while inspecting the fixed crest weir with barge bay, we observed the guard rail at entrance to the barge bay on the west side was bent. This damage appears to be caused by oilfield barges accessing the barge bay and colliding with the bulkhead. No storm damage was noted.



Structure #6 – photo of bent guard rail on the west side of barge bay.

As noted in previous inspections, there is a small breach (approximately 5 feet wide) located on the east bank of Carencro Bayou across from an existing camp location between an electrical pole and guide wire. The breach doesn't appear to have worsened as a result of Hurricane Rita.



Photo of breach located along Carencro Bayou near electrical pole.

While inspecting the overflow banks along Carencro Bayou and Little Carencro Bayou, we observed three (3) breaches which were a direct result of Hurricane Rita. These earthen banks were in good condition and intact prior to the storm. Below is a map showing the approximate locations of these breaches along with photographs:

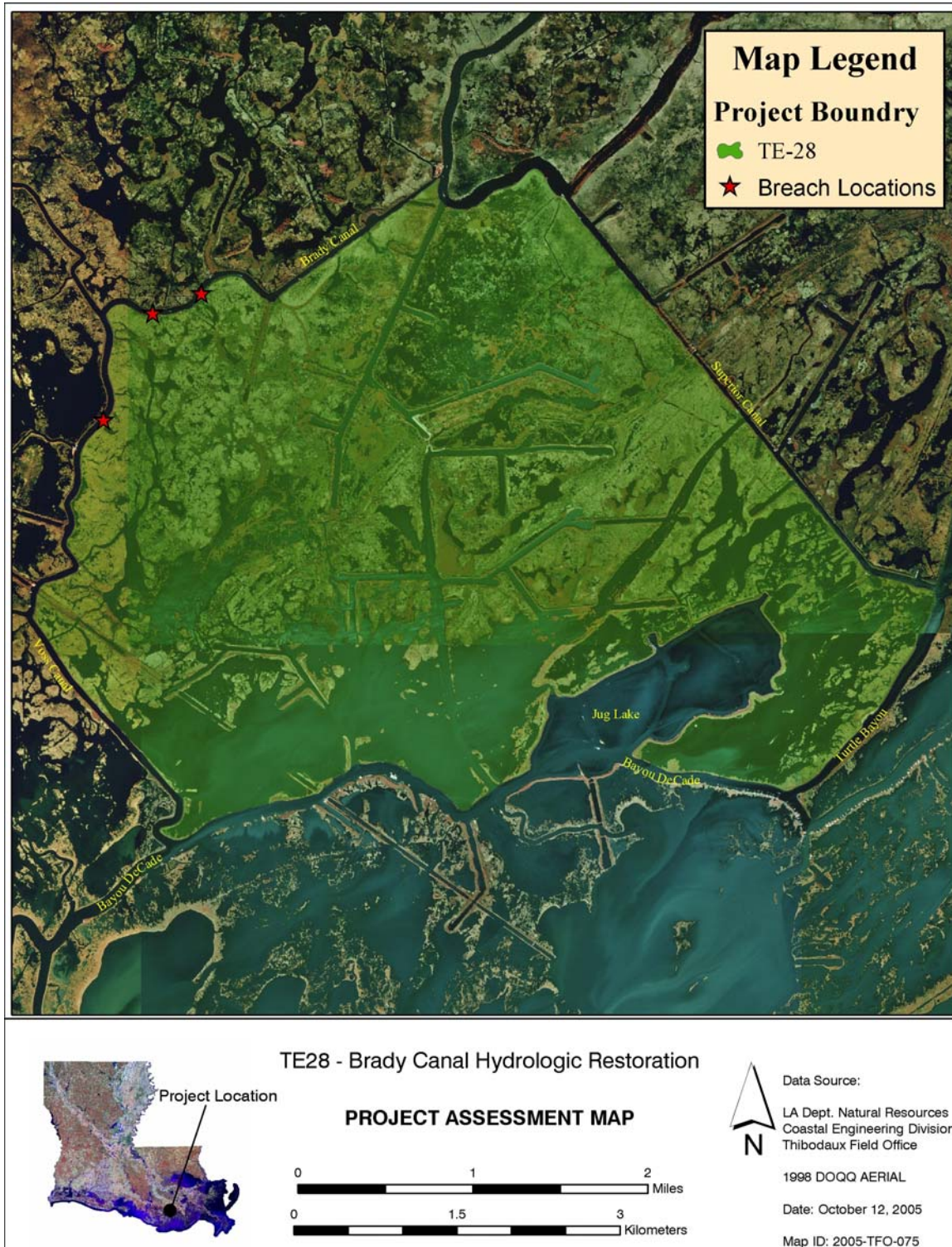




Photo of breach (approximately 20 ft. wide) located along east bank of Carencro Bayou.



Photo of breach (approximately 25 ft wide) located along east bank of Little Carencro Bayou.



Photo of breach (approximately 80 ft wide) located along east bank of Little Carencro Bayou.

V. Conclusions and Recommendations

The damage assessment of the Brady Canal Hydrologic Restoration Project (TE-28) revealed several breaches along the east bank of Carencro Bayou and Little Carencro Bayou and significant erosion adjacent to Structure No. 23 directly related to the storm surge produced by Hurricane Rita. It is recommended that the damaged mentioned above be restored using dredge material from the adjacent bayous and lake to raise the breached overflow banks and earthen tie-ins to their design elevation.

After discussing the method of repairs with the federal sponsor and landowners, we concluded that the damages are not significant enough to warrant FEMA (Federal Emergency Management Agency) assistance and repairs should be funded by the CWPPRA maintenance program. The landowner (Burlington Resources) has offered the use of their resources to make the necessary repairs under the in-kind services clause of the Brady Canal Cost-Share Agreement.

References:

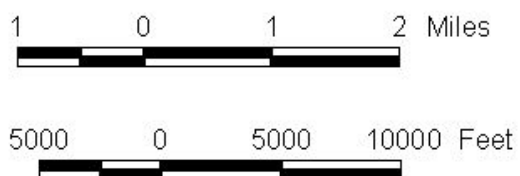
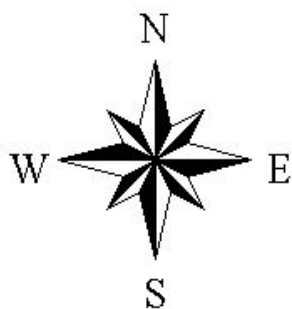
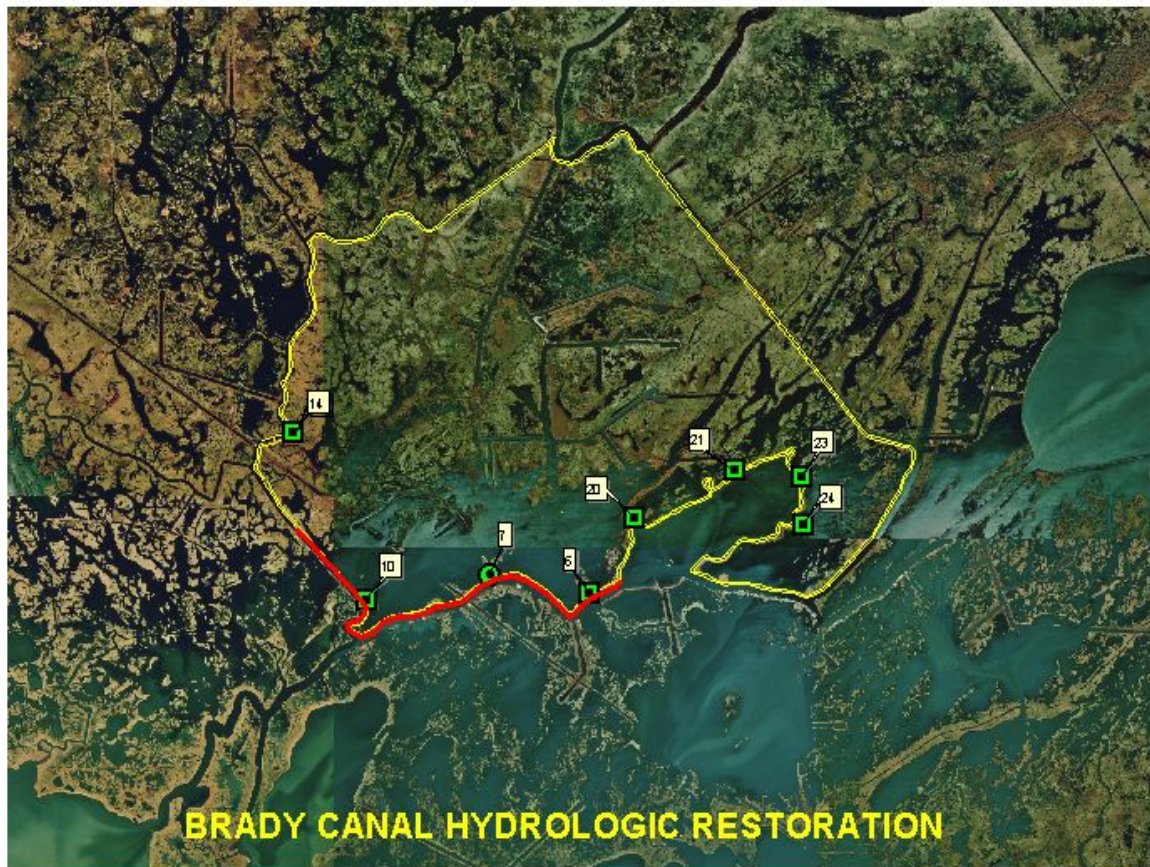
Broussard M. Garrett, February 2006. Damage Assessment Report for Hurricanes Katrina and Rita, Louisiana Department of Natural Resources, Coastal Engineering Division. 5 pp.

Folse, Todd, August 2003. Monitoring Plan, Brady Canal Hydrologic Restoration (TE-28), Louisiana Department of Natural Resources, Coastal Restoration Division.

LDNR, February 2002. Operation, Maintenance and Rehabilitation Plan, Brady Canal Hydrologic Restoration (TE-28), Louisiana Department of Natural Resources, Coastal Engineering Division.

United States Department of Agriculture, Natural Resources Conservation Service, 1998. Project Plan and Environmental Assessment for Brady Canal Hydrologic Restoration, Terrebonne Parish, Louisiana.

Attachment I
Project Features Map







Data Source:
 La. Dept. of Natural Resources
 Coastal Restoration Division
 Field Engineering Section
 Thibodaux Field Office

1998 DOQQ's

Date: July 22, 2002
 Map ID: 2002-TFO-086

LEGEND:

-  - Project Boundary
-  - Shoreline Protection
-  - Weir Structure
-  - Plug Structure

Attachment II

Three Year Budge Projections and Worksheets

2006 Annual Inspection Report
 BRADY CANAL PROJECT
 State Project No. TE-28

Brady Canal/ TE-28 / PPL 3				
Three-Year Operations & Maintenance Budgets 07/01/2006 - 06/30/09				
Project Manager	O & M Manager	Federal Sponsor	Prepared By	
	Brian Babin	NRCS	Brian Babin	
	2006/2007	2007/2008	2008/2009	
Maintenance Inspection	\$ 5,250.00	\$ 5,407.00	\$ 5,569.00	
Structure Operation	\$ 16,000.00	\$ 16,000.00	\$ 16,000.00	
Administration	\$6,500.00	\$ 5,000.00	\$ 6,500.00	
Maintenance/Rehabilitation				
06/07 Description: Routine Levee and Navigational Aid inspection, maintenance and repairs.				
E&D	\$6,000.00			
Construction	\$35,000.00			
Construction Oversight	\$5,000.00			
Sub Total - Maint. And Rehab.	\$ 46,000.00			
07/08 Description: Navigational Aid inspection, maintenance and repairs.				
E&D		\$ -		
Construction		\$ 5,000.00		
Construction Oversight		\$ -		
Sub Total - Maint. And Rehab.		\$ 5,000.00		
08/09 Description: Routine Levee and Navigational Aid inspection, maintenance and repairs.				
E&D			\$ 6,000.00	
Construction			\$ 35,000.00	
Construction Oversight			\$ 5,000.00	
		Sub Total - Maint. And Rehab.	\$ 46,000.00	
	2006/2007	2007/2008	2008/2009	
Annual O&M Budgets	\$ 73,750.00	\$ 31,407.00	\$ 74,069.00	
O & M Budget (3 yr Total)			\$179,226.00	
Unexpended O & M Funds			\$453,639.69	
Remaining O & M Budget (Projected)			\$274,413.69	

OPERATIONS & MAINTENANCE BUDGET WORKSHEET

Project: TE-28 Brady Canal Hydrologic Restoration

FY 06/07 –

Administration	\$ 6,500*
O&M Inspection & Report	\$ 5,250
Operation:	\$ 16,000
Maintenance:	\$ 46,000
E&D:	\$ 6,000
Construction:	\$ 35,000**
Construction Oversight:	\$ 5,000

Operation and Maintenance Assumptions:

Structure Operations: 3 – structures are operated twice annually for a total of \$8,000 per operation. (2)(\$8,000) = \$16,000. LDNR Administration: \$2,000*

Maintenance:

As a result of the post storm damage assessments, recommendations were made for the repair of three (3) breaches located along the east bank of Carencro and Little Carencro Bayous and levee refurbishment of low area adjacent to the variable crest weir structures.

Navigational Aid inspection, maintenance and repairs: \$5,000**

Construction Cost Breakdown (Based on in-kind service by Burlington Resources)

Mobilization:	\$10,000
Breach Repairs:	\$15,000
(1000 linear ft. @ \$15/ ft.)	
Contingency (20%)	<u>\$ 5,000</u>
	\$30,000**

Construction Oversight: (Burlington Resources)	\$ 5,000
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As-built Survey:	\$ 6,000
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LDNR Administration:	\$ 3,000
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NRCS Administration:	\$ 1,500
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Overall Project Cost:	\$45,500
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FY 07/08 –

Administration		\$ 5,000*
O&M Inspection & Report		\$ 5,407
Operation:		\$ 16,000
Maintenance:		\$ 5,000
E&D:	\$ 0	
Construction:	\$ 5,000**	
Construction Oversight:	\$ 0	

Operation and Maintenance Assumptions:

Structure Operations: 3 – structures are operated twice annually for a total of \$8,000 per operation. $(2)(\$8,000) = \$16,000$

Maintenance:

Navigational Aid inspection, maintenance and repairs: \$5,000**

LDNR Administration: \$3,000*

NRCS Administration: \$2,000*

FY 08/09 –

Administration		\$ 6,500*
O&M Inspection & Report		\$ 5,569
Operation:		\$ 16,000
Maintenance:		\$ 46,000
E&D:	\$ 6,000	
Construction:	\$ 35,000	
Construction Oversight:	\$ 5,000	

Operation and Maintenance Assumptions:

Structure Operations: 3 – structures are operated twice annually for a total of \$8,000 per operation. $(2)(\$8,000) = \$16,000$

Maintenance:

It is anticipated that miscellaneous earthen breaches and navigation lights will have to be repaired during the fiscal year. The cost above is based on in-kind service credits to the landowner for repair of breaches. Cost breakdown shown in FY 06/07.

Attachment III

Field Inspection Notes

10.204m

Oct 5, 2006

TE-28 Brady Canal - Hurricane
Rita Damage Assessment

Participants: B. Robin
D. Lee
B. Sticker (NRCC)
A. Phillips
E. Adams (Burlington)

Maintenance Project (2003) - Site 7
Rock Plug - No Jettlement - No
Damage from Rita.

Turtle Bayou Gauge: 1.65' INAD²

March: vegetation along spoil
banks are burnt from salt water
influx from Hurricane

Rock Dike along Bayou Decade
no damage. Rock dike covered
up vegetation from storm

Structure #24 - No Damage from storm
earthquake - same condition as
ANNUAL INSPECTION.

Jug Lake.

Structure 23 - North earthen tie-in has eroded around steel bulkhead but has not breached. Watch closely on future site visits. No significant damage from storm. TBS installing stop logs.

Structure No 21 - no damage from storm. Earthen tie-in in good condition.

Spill material along west bank of Jug Lake - held up well during storm. No breaching. Large cut banks along face of levee.

Structure 20 - rock-lined channel. No damage from storm.

Structure No 6 - west of barge bay. Good condition west side of sheet pile wall damaged at entrance to barge bay. Staff gauge behind structure damaged.
No Reading

Water elev. +2.5' NAVD. measurement off of channel top on Structure #6.

Point of rock revetment east west of Structure #6 has settled over time.

Structure #7 - rock pile in good condition. No apparent damage.

Structure No 10 - no apparent damage from storm - structure in good condition.

Small breach located along Commerce Bayou access from camp. Has not worsened from storm surge. Approximately 5' wide.

Structure No. 14 - good condition. No breaching around earthen tie-in. Marsh side of structure - water hyacinth clog opening of structure. Notice this on previous inspection.

Small breach^① along Carriero Bayou
(5' wide) - coordinates taken.
Breach due to storm.

Carriero VTM 069,4189
Bayou zone 15 328,3696

Little Carriero Breach^② 694,640 4' wide
Bayou 325,4630

Breach^③ 695,090
Opposite ~~3,243~~ 3,254,863
80' wide

Little Carriero Canal clogged w/ water lilies
Bayou